No. XIII. thus running from 1828 to 1916. The deficiency of severe winters in the last column is striking.

Frequency of (a) *Cold,* (b) *Severe Winters,* 760–1916.

89-year Period	Period-year 1–22		Period-year 23–45		Period-year 45–67		Period-year 68–89	
No.	Cold	Severe	Cold	Severe	Cold	Severe	Cold	Severe
I.	1	(1)	0	(0)	1	(1)	0	(0)
II.	1	(1)	1	(1)	2	(1)	2	(0)
III.	2	(1)	1	(0)	3	(1)	1	(0)
IV.	3	(1)	2	(0)	2	(2)	1	(0)
V.	3	(1)	2	(1)	2	(1)	0	(0)
VI.	5	(2)	1	(1)	3	(1)	1	(0)
VII.	2	(1)	3	(1)	2	(0)	1	(1)
VIII.	3	(0)	2	(1)	3	(2)	2	(1)
IX.	1	(0)	2	(1)	2	(0)	1	(0)
X.	2	(1)	2	(0)	2	(2)	0	(0)
XI.	4	(1)	1	(1)	3	(1)	0	(0)
XII.	1	(1)	3	(0)	4	(3)	1	(0)
XIII.	2	(1)	2	(0)	2	(2)	1	(0)
VIII.–XIII.	2·2	(0·7)	2·0	(0·5)	2·7	(1·7)	0·8	(0·2)
I.–XIII.	2·3	(0·9)	1·7	(0·5)	2·4	(1·3)	0·8	(0·2)

The conclusions of the whole investigation may be summarised as follows (all this relates, of course, to winter temperatures in W. Europe):—

(1) Within each interval of 44½ years (759·5–803·0 . . . 1872·0–1916·5), the first half is colder than the second.

[The difference in the amount of temperature-deviation has been found on an average 20° per 44 winters; after the year 1383 on an average 26°.

Exceptions, or apparent exceptions, from this rule, two out of twenty-six cases since 760, none since 1200.]

(2) Within each interval of 89 years, to begin with the year 759·5 (1827·5), the first half is colder than the second.

[The difference in the amount of temperature-deviation has been found on an average 22° per 89 winters.

Exceptions from the rule, two out of thirteen cases since 760, besides two doubtful ones; since 1116 one exception.]

(3) The chance that the last quarter of an 89-year period (826·25–848·5 . . . 1894·25–1916·5) contains a smaller number of hard winters than the preceding and following 22-year intervals is 0·88. Within the last quarter of an 89-year period the chance that any winter will be severe (or very severe) is less than 0·4 (or 0·007), *i.e.* less than ½ (⅕) of the general chance. In the neighbouring 22-year intervals (*e.g.* 1872–93 and 1916–37) this chance is about three (five) times as great.

(4) Increased and accelerated activity of the solar surface corresponds in general with the winter-cold in Western Europe setting in more forcibly and quickly than usual; inversely, a weakened and retarded activity of the sun corresponds with winters setting in more mildly and in a later part of the period.

The forecast for the period 1917–38, derived from these statistics, indicates at least two very cold and one severe winter; the average winter temperature for these twenty-two years being generally below the 89-year mean.

C. Easton.

Amsterdam, June, 1917.

Auroras and Magnetic Storms.

With reference to your note in Nature of August 16 referring to a magnetic storm on the night of August 9–10, it may be of interest to learn that an aurora was seen here that night. It was first seen a few minutes before 10 p.m. (G.M.T.), when it appeared as a glow in the northern sky. Two streamers were just discernible at first, but they gradually increased in numbers and became clearer, at the same time growing longer and brighter and moving towards the west. The longest reached to the centre of the Great Bear. Small, sharp, and delicate streamers, although not prominent, were distinctly seen in the larger streamers. There was no colouring seen at all, but merely a white glow. By 11.15 all traces of it had vanished.

L. Cave.

Testing Squadron, Royal Flying Corps,
Martlesham Heath, Suffolk, August 21.

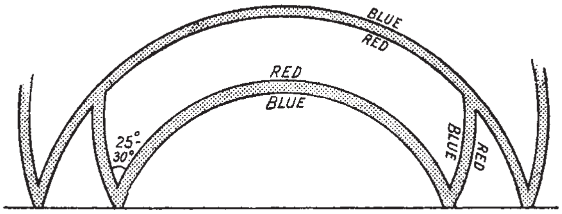
An Unusual Rainbow.

An unusual rainbow display was visible at sea between 6.30 and 7 p.m. on the evening of August 16. The primary and secondary bows were complete and of exceptional brilliancy. Between these two lay two arcs of a third bow, cutting the primary bow near the horizon and ending in the secondary bow about 20° above the horizon in the manner shown in the accompanying diagram.

The blue of this bow was towards the primary bow, and the red towards the secondary bow. This third bow cut the primary bow at an angle of 25°–30°.

Outside the secondary bow were visible two arcs of a fourth bow (less distinct than the others) which cut the secondary bow in much the same way as the third cut the primary.

Unfortunately, I am unable to give you at present the ship's position at the time when the phenomenon was seen. The sun's altitude was about 7° when the bows were most clearly seen. The afternoon was warm and sultry and there was practically no wind. A thunderstorm took place at some distance from the ship during the afternoon.



I shall be glad if any of the readers of Nature can give me an explanation of the phenomenon, which has caused considerable discussion among the officers of the ship.

Allan J. Low.

August 16.

An Invasion of Ants.

Yesterday afternoon (Bank holiday) the weather suddenly became brilliantly sunny and very hot, after some days of gloom with rain and thick east wind atmosphere; and about five o'clock I became aware that apparently every ants' nest in the garden had chosen that precise moment for the emergence of its winged inhabitants. There they were in myriads, swarming out of holes in the drive, gravel paths, flagstones, the rock-garden, where they had been devastating Sempervivum clumps, and all over the lawns. They were nearly all the small red ant, only a few nests of the small black one.

The tiny winged males much outnumbered the large-bodied winged females, and both were attended by fussily anxious "workers"; by seven o'clock all were gone. Can ants delay their appearance above ground until the onset of suitable hot, dry weather?

Eleonora Armitage.

Dadnor, Herefordshire, August 7.

The appearance in swarms of male and female ants for the nuptial flight is described by many observers.

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References will be found, for example, in Mr. H. K. Donisthorpe's recent book on "British Ants" to the species *Myrmica rubra* and *Lasius niger,* which are probably those noticed by Miss Armitage. Her observation is of interest in showing how the workers direct the exodus of the winged forms when weather conditions become favourable.—EDITOR.

THE ADOPTION OF THE METRIC SYSTEM.

THE controversy with reference to the metric system appears to have passed through two stages and to be approaching the climax of its third, and possibly final, stage. In the first stage the glamour of its uniformly applied denary scale, and of its carefully related standards of length, area, volume, and weight, carried the general public in an apparently wholehearted advocacy which was clearly reflected in the early divisions on the Metric Bill in Parliament. Advocates of the binary scale might attend metric meetings and tear up sheets of paper into two, four, and eight parts; theorists with the duo-denary scale might drag a red-herring across the trail; workers with the most convenient of the English weights and measures might voice their fears of a bad exchange in units of measurement; but the metric advocates carried the day, in most cases with a wonderful accompaniment of popular, if not business, enthusiasm.

The second stage was reached when the practical business men were actually forced to take cognisance of the movement and either accept, or work vigorously against, it. The natural thing happened—how could it be expected that British controllers of industry—industry inductively developed—should be other than short-sighted and insular in their ideas? The nation which deliberately attempted to cut itself off from the Continent in the sixteenth century by adopting a different Latin pronunciation was not likely in the nineteenth to be ready to accept at once any Continental standard, even in weights and measures. Every conceivable objection was raised—and it is perhaps as well that this was so; for we now understand much more clearly the "pros and cons" of the case.

Possibly the greatest difficulty, which has still to be overcome, is the inborn tendency not only of British, but also of all traders to vary their trading conditions. "Tare and *tret*" accounts have only just vanished from our book-keeping—37 inches are still allowed to the yard; there are several pounds; apparently a stone may be 8 lb., 14 lb., or 16 lb.; a hundred may be a hundred, or a hundred and twelve, or a hundred and twenty (a great hundred) units; while we have also such things as "strikes," "bags," "boxes," etc., of very questionable contents. Such variations tend to promote that "opportunism" which is at daggers drawn with the wider and more humane view of commerce. The tendency to perpetuate this heterogeneity is not only British; it is international, and is undoubtedly one of the weaknesses which mankind as a whole must face and fight if larger opportunities for international service are to be won.

This inherent tendency explains why even among metric nations the metric system has not always conserved its pure form, and why among non-metric nations the metric system has not been introduced even into recently developed industries. Man has to fight against himself, or rather against certain of his intuitive tendencies, to become the controller of his own environment. Thus, when Mr. W. R. Ingalls, in his paper read before the Institution of Mining and Metallurgy on May 24, confesses to thinking more clearly in the pound than in the kilogram, the present writer is reminded of how for years his personal unit of weight was the 8-lb. to 9-lb. hare which he carried when accompanying certain of his relatives on their shooting expeditions. The suggestion undoubtedly is that the sooner we definitely teach our young people to work and think in carefully standardised units, instead of allowing them to adopt units accidentally coming within their cognisance, the better for us as a nation and for the world in the broadest sense. Have we yet realised the advantages of deliberate intent, as distinct from casual drift, in this and other similar problems which we must face?

We are now in the third stage, in which the objections to the denary scale and the metric units have practically disappeared. Thus the two problems which to-day are being seriously debated are:

(1) If the metric system is the only possible system that may be universally adopted, will the expense entailed in its adoption by non-metric countries be more than balanced by the advantages gained in the reasonably immediate future?

(2) If it is desirable to adopt wholeheartedly the metric system throughout our industries, how may this best be effected with reference to both our working staffs and the material means by which metric measurements may be made?

With reference to the first proposition, there is no need to discuss the possibility of the universal adoption of the British system rather than the metric system, for two reasons. The first is that there is no British system. Take the textile industries as an example. The Bradford manufacturer speaks a more difficult textile language to the Leeds manufacturer than the Continental manufacturer employing the metric system; and instances might be multiplied. Again, the most standardised of all the British systems—the avoirdupois—scarcely bears signs of its British origin on its face. The second reason is that year by year, month by month, and almost week by week, our industries are being more and more controlled from their laboratories—and all scientific laboratories adopt the metric system. What confusion and mistakes there will ultimately be unless uniformity is here enforced!

Looking at the problem from the broadest basis, Mr. Ingalls' paper is a delightfully unconscious portrayal of the typical British (or American) attitude of mind. We must make our drawings in our own units, and if the French want them they

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